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Maine Agricultural Experiment Station

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POULTRY EXPERIMENTS.

This bulletin contains an account of investigations in breeding poultry for egg production; the methods employed in the selection of breeding stock; and detailed accounts of the methods of feeding hens and chickens.

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POULTRY EXPERIMENTS.

G. M. GOWELL.

[The poultry work of the Experiment Station was undertaken primarily to study breeding for egg production and has been in progress for several years. A year ago the Bureau of Animal Industry of the U. S. Department of Agriculture desired to cooperate in the work and is now contributing $1,000 per year to assist in the carrying forward of the breeding experiments. Considerable unpublished data from these experiments have accumulated, but it has been decided to hold this matter for another year before it is published, at which time it will probably be issued as a bulletin of the Bureau of Animal Industry.

The following papers on poultry experiments have been published. With the exception of Bulletin 100, these are no longer available for distribution.

Number of Laying Hens that can be profitably kept in one Pen, Annual Report for 1898.
Feeding Chickens for Growth, Bulletin 64.
Breeding for Egg Production, Bulletin 64.
Feeding Chickens for Growth, Bulletin 79.
Experiments in Incubation, Bulletin 79.
Breeding for Egg Production, Bulletin 79.
Breeding for Egg Production, Bulletin 93.
Floor Space, etc., in relation to Egg Production, Bulletin 93.
Poultry Management as practiced at the Maine Station, Bulletin 100.

This bulletin (117) presents some of the results of the breeding work and supplements Bulletin 100 by outlining the methods of housing and handling our stock that have been adopted since that bulletin was issued.—C. D. W.]

INVESTIGATIONS RELATING TO BREEDING TO INCREASE EGG PRODUCTION IN HENS.

SUMMARY OF RESULTS OBTAINED.

In order to select good producing hens for foundation breeding stock, we constructed 52 trap nests and placed them in the laying pens where 140 April and May hatched pullets commenced using them November 1, 1898.

In one year forward from that date the 140 birds laid an average of 120 eggs each. Twenty-five laid over 160 each and 22 less than 100 each. Hen No. 36 laid 201 eggs; No. 101 laid 204; and No. 286 laid 206 eggs. The eggs of No. 36 were light in color and she was therefore rejected as a breeder.

At the commencement of the next breeding season,—1900—Nos. 101 and 286 were mated with males that were unrelated to them, or to each other. The cockerels raised from the eggs of these two birds were the first males produced for use in this work.

In the early spring of 1901, several sons of hen No. 286, raised the previous year, were mated with the 24 two-year-old hens that laid 160 eggs and over, each, during 1899, and 25 others that laid 160 or over during the 1900 test. That season hen No. 303, who had laid 208 eggs during 1900, was bred to a son of 286. Hen No. 326 had laid 211 eggs during 1900 and she was bred to a son of No. 286 also. No. 318 had laid 237 good brown eggs in 1900. After she had laid 200 eggs the next dozen she laid weighed 1 ℔. 11¼ ounces. She was bred to a son of No. 101 that season. The sons of No. 101 and 286 were in service only during the year 1901.

During 1902 one hundred pullets were tested for additional foundation stock. They yielded an average of 132 eggs each. Twelve birds laid over 200 eggs each; the highest number being 251 eggs laid by hen No. 617. In the same pens were six others that laid only from 23 to 70 eggs each. Thirty-seven laid over 160 each. No hens were used as breeders that had not laid 160 eggs, and all, as in the previous year, were bred to males whose dams had yielded over 200 eggs.

Males were raised this year, (1902) for the male breeding pens of the next year, from hens No. 635, record 201 eggs, and

No. 676, record 209 eggs. The eggs from both of these hens were very large and dark brown. They were mated to sons of No. 303 and 318 before spoken of. Males for the pullet breeding pens of the next year were bred from other matings of hens, that had produced 200 eggs, with males whose mothers had yielded over 200.

That year (1902-3) we were crowded for room and could accommodate only 53 pullets for testing. They were the first pullets that we tested that were sired by males bred from 200 egg producing hens and show the first results of the breeding practiced. They had been laying quite heavily out on their summer range during September and October, although they were not hatched until April and May. The 53 birds laid 7,952 eggs in the year forward from November 1st, a little better than 150 eggs each. Could they have been in quarters where their eggs could have been traced to them a month earlier, when they were laying so well, they would have shown a better year's work, as the twelfth month of their testing was really the thirteenth month of their laying, and the record sheets show it to be nearly bare of eggs. As it was, however, seven of the 53 show records of from 201 to 240 eggs each in the year, and 23 of the 53 laid over 160 eggs each.

During the breeding season of 1903, hens No. 1,001, record 213 eggs; No. 1,003, record 240 eggs; No. 1,005, record 222 eggs and No. 1,140, record 211 eggs, were bred to male birds raised the year before whose dams had yielded over 220 eggs each, for the purpose of procuring males, for the male breeding pens of 1904.

All pullets raised that year (1903) were, as in the preceding three years, out of hens that had laid over 150 eggs in a year, and they had the advantage over their predecessors, in that their dams and maternal grand dams were sired by males whose mothers had yielded 200 eggs, or over, as they themselves also were.

That year (1903-4) 160 pullets were tested in the trap nests. They laid 21,202 eggs; an average of 132 each. Forty-four laid over 160 eggs each; 8 laid 200 or over, viz. 200-205-210-217-220-221-222 and 225 each. We have not to seek far for an explanation for the lower average yield than that of the last preceding year. The pullets were hatched in April and May, and thinking to have them mostly in readiness for laying early in November, we fed them rather more beef scrap than usual during the growing season, while they were out on the range, and before we were aware of their development they were laying,—in August. They were nearly all laying heavily during September, October and November. They were splendid birds, but almost every one of them moulted, completely, in December, and we got very few eggs from them for more than two months. The most of the eggs secured from them were laid after the middle of January. Could they have commenced laying in October and continued for a year, moulting would probably have been avoided and the showing would have been much better.

The breeding season of 1904 opened with 170 yearling hens in our houses that had laid above 160 eggs each the year before; 80 pullets and hens whose mothers had laid over 200 eggs per year; and 28 hens that had themselves laid over 200 eggs per year. These birds were in 24 different pens and they were bred to selected cockerels whose mothers had yielded above 200 large brown eggs per year.

Among the pullets tested during the last preceding year (1903) were found the following; No. 263a yielded 220 eggs; No. 225a, 220 eggs; No. 222a, 221 eggs; No. 224a, 222 eggs; No. 205a, 225 eggs. These birds were bred during 1904 to cockerels raised in 1903 from heavy producing mothers whose other sons were never used in our breeding operations. The mating of these five pairs of birds was to secure cockerels for our next year breeding operations.

At the usual time for the commencement of the yearly test of 1904, viz. October 30, we had 300 good pullets that were laying well out on the range. The construction of the building being erected for their quarters was interfered with by a question of labor, over which we had no control, and they remained out in their small summer homes during a wet, cold fall and early winter, until December sixth, when they were moved in. This more than a month's delay and exposure cut into the year's work heavily and the average production of the 300 birds was reduced to 131 eggs each during a little less than eleven months. Eight birds yielded above 200 eggs each before the close of the following October.

All of the breeding females we are now carrying are tested hens that have laid from 160 to 251 eggs in a year; and 150 pullets and hens whose mothers produced 200, or over, eggs per year. All males used in breeding these two classes since 1901 had mothers that had laid 200 or more eggs in a year.

This season (1905) six hundred pullets out of hens that have laid above 160 eggs per year, and whose fathers, grandfathers and great grandfathers were out of hens that yielded above 200 eggs per year are being tested by the trap nests for additional breeding stock. All of the mothers of these pullets had fathers and grandfathers that had 200 egg producing mothers.

The stock is strong and vigorous and but few chickens that hatch are lost. The hardihood of the stock is shown by the fact that many cockerels have been sold to farmers and poultrymen in and out of the State during the past two years and this fall many of them have ordered again, with the frequent comment that their pullets are laying earlier in the season and giving better eggs than they have ever done before.

The numbers of the breeding stock now secured makes practicable the avoidance of in-breeding and this is strictly guarded against, as it is doubtful if the inbred hen has sufficient constitution to enable her to withstand the demands of heavy egg yielding. During only one season, have birds as closely related as first cousins been bred together. Line breeding is followed, the matings now being only with distantly related birds. These breeding investigations have now been in progress for six years. The first year was consumed in testing pullets to find foundation stock. The second year cockerels were raised from the large laying hens for future breeding, and the third year, the first lots of pullets were raised from the selected stock; so that we have only the last three years in which to note results and these three years can only show the first changes that have taken place. The stock that we commenced with was well bred, as flocks generally go. The hens were averaging about 120 good brown eggs a year, and had been doing so for several years. Three years ago they averaged 150 eggs and the last two years, with the great setbacks caused as above indicated, which was no fault of the stock, the average was 131½ eggs. It must be borne in mind that 1902 was the first year we had pullets from the 200 egg stock to collect eggs from. In the records, only the eggs laid in the nests are accounted for. Had those found on the floor been reckoned in, the average per bird would have been slightly increased.

As the housing, treatment and food, have been as nearly alike as we could make them during the last five years, there seems to be reason for assuming that the flock yields of 1902, 1903 and 1904 over those of previous years are the results of the breeding practiced.

Sufficient time has not yet elapsed since beginning these breeding tests to establish claims of increased productiveness, but the outlook is certainly very encouraging.

The plans on which we are working are based on every-day common sense. We are rejecting the drones and breeding producers together to secure producers. It is known that the laws of inheritance and transmission are as true with birds as with cattle, sheep and horses, and when we consider the wonderful changes that have been made in the form, feather and egg production of hens since their domestication commenced, there is ample reason for assuming that a higher average egg production than the present can be secured, by breeding only from those birds that are themselves great producers.

The purposes of this work should not be misunderstood;—we are not trying to breed stock that shall average to yield 200 eggs per year. If the average yield of the hens of the breed should be increased to the extent of a dozen eggs per bird, the value of the work would be many times its cost.

OTHER METHODS OF SELECTING BREEDING STOCK.

During last August we found 29 of the pullets that were hatched the first of April, were laying in the brooder houses out on the range. They were carried into the laying houses, banded and given access to trap nests. They were given our usual treatment and feed and we commenced keeping records with them September first and will continue doing so through the year.

On April 30 the 29 birds had laid 3,317 eggs. Their individual records were as follows, viz. 95, 93, 91, 133, 115, 58, 102, 149, 130, 100, 76, 95, 114, 101, 110, 127, 149, 68, 107, 134, 126, 135, 135, 136, 125, 130, 164, 86, 133. The average number to each bird was practically 115. We have no special market for our eggs as we need to use them in large numbers in experimental work when occasions require. At the prices which we received from the commission house in Boston for eggs sent there from September to April the 3,317 above mentioned would have returned $87.57, an average of $3.01 per bird for the eight months' work.

The above is not cited as phenomenal work, but it is better than our birds average when all of them are accounted for. These 29 were not the only promising pullets we had, but they were all there were in that division. What returns they will make during the four months that remain from April to the close of August can not be learned until the year's work ends, which with them will be August 31.

While the egg yields of this group of birds were very satisfactory, the money returns from them were particularly so, for the reason that they did their work during that part of the year when prices were highest.

We are making our selections of breeding stock by aid of the reliable data secured by the use of trap tests. It is only investigators and occasional poultrymen who can afford the equipment and expense of operating trap nests. Every poultryman can, however, by closely observing his young stock during autumn, select the pullets that are commencing or preparing to lay and secure a pen of birds for the next season's breeding, that have the function of egg production so strongly developed in them that they give evidence of it by the early exercise of that function. Of course not all prospective layers prove satisfactory; some are not able to stand the demands of heavy work and so lay irregularly or fall out altogether. In this group of 29 birds, four proved to be low producers and should be rejected as breeders. Four others yielded from 90 to 100, but as the work was done during the time when the products were valuable they are worth breeding from. Six others yielded from 100 to 114 during the same period and they are still more valuable. Fifteen of this group of 29, selected in the field, laid from 115 to 164 each.

Although there are some poor yielders in this pen of 29, it is probable that as a lot they average considerably better than the whole flock from which they were selected. The small number of unprofitable birds and the large proportion of good ones would warrant the method of selection as the best, when trap nests, or equally reliable methods of selection are not practicable.

Early maturity in pullets is generally accompanied by physical vigor and when the function of such birds is to produce eggs, and they give evidence of it, they are certainly the best of their race to breed winter egg producers from, if we accept past experiences in breeding as our guides.

The records of a full year's laying in trap nests would be better as that would enable the rejection of all poor workers; and as the birds would not be bred from until the year following, they would be more mature and the chicks would be larger when hatched and would develop into larger birds at maturity than they would if their mothers were doing their first year's laying. The differences in size from these causes, have been very noticeable in our work.

Poultry men are generally desirous of securing as many well bred pullets as possible and so use yearling hens as breeders, in addition to their two-year-olds. The work done by pullets from September to February or March is pretty good indication of their usefulness and their eggs are available for breeding during the pullet year. While the chickens from such eggs are not generally as large at maturity as those from older hens, we have not been able to discover any lack of constitution or vigor in them, and know no reasons why they are not desirable as workers.

THE PEDIGREE CHARTS.

In order to make clear our methods of breeding and registering, there are appended hereto two pedigree charts which illustrate the breeding of the two classes of birds which we designate as "registered" and "unregistered." We do not use these terms with reference to purity of blood, for ours is one of the oldest of the families of Barred Plymouth Rocks, having been bred by the writer for 25 years from the best Barred Rock stock which was procurable at the time of starting.

Every one of our birds is pure blooded in the same sense that all registered cattle, horses, sheep and swine are pure, and every one of our hens is numbered with duplicate bands, and individual book accounts are kept with each, whether she produces much or little. The same is true of all males so far as purity of blood is concerned.

In our work the term "registered" is used solely with reference to performance, which in work with Jersey or Holstein cattle would mean registered in the "advanced registries" of those breeds. We have registered no female unless she had laid 200 or more eggs during the first 12 months forward from the day on which she laid her first egg. We have registered none of her daughters unless they themselves had laid at least 200 eggs per year.

We register all of the sons of registered hens, and designate them as registered males. They are no better bred than their own sisters which we reject from registry when they do not prove to be heavy performers. Were there some practicable means by which we could determine the ability of the male to transmit to his offspring the high egg producing function of his dam, we would apply the same rigid rule of selection to him that we do to his sisters.

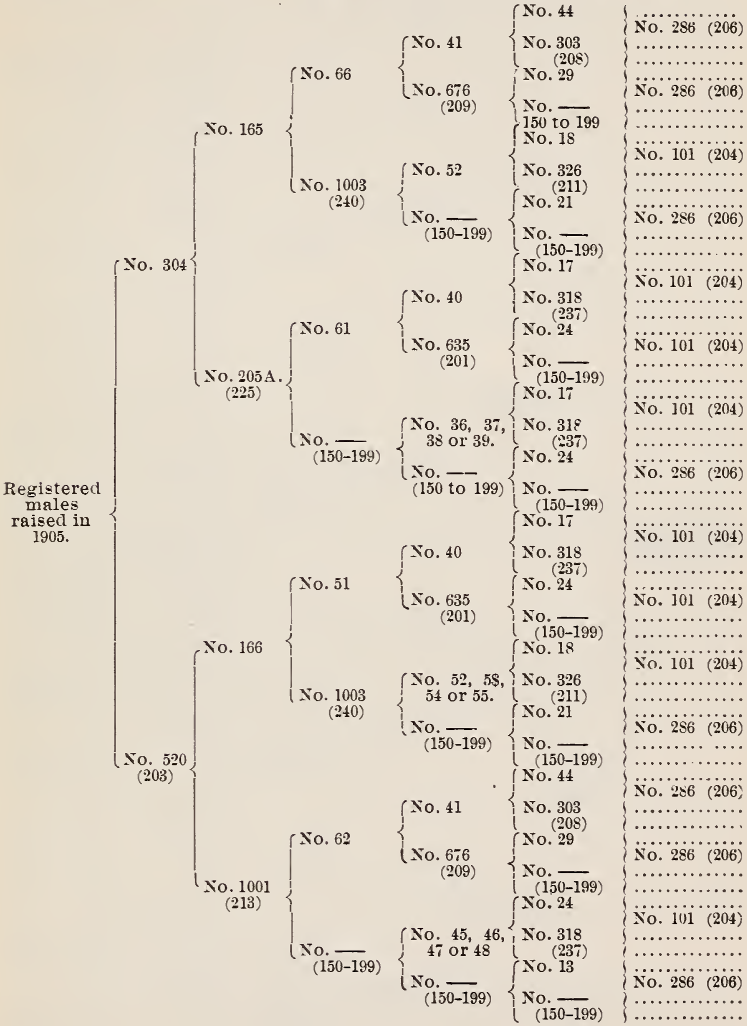
There was no reason why we should select 200 as the number of eggs necessary to entitle a bird to advanced registration. It is a high record—much higher probably than large flocks will ever be made to average, in our time. Perhaps we might have taken 190 or 210 with equal propriety,—just as horse men might have selected some other time than 2.30 by which to determine a *standard horse.*

The unregistered cockerels and pullets are as well bred on their fathers' side as the registered ones are, but, while the registered ones have dams that produced 200 eggs or over, the mothers of the unregistered ones laid from 150 to 199 eggs in their first laying year. It is among these unregistered pullets that we have found the most of the 200 egg producers who are each year added to the foundation breeding stock.

The charts shown are only given as examples of the breeding. In the male breeding pens nearly 30 different hens are employed this year, which give as many different pedigrees. In the unregistered female breeding pens are several hundred breeding hens, each giving pedigrees to their progeny. In the chart illustrating the breeding of the registered males, it is shown that his mother and her mother were both producers of over 200 eggs. We have two other similar instances where the daughters of 200 egg producers are themselves 200 egg producers. This has not generally been so, probably because the hen that laid heavily one year did not commence laying until so late the following year that their pullets came into laying too late in the year to make great records for themselves. Several hundreds of the unregistered cockerels have for each of the last three years been sold to poultrymen and farmers and a great deal of commendation has been expressed relative to the benefits derived from their use in securing earlier and increased egg yields.

The first chart shows the breeding of the registered males that were raised in the present breeding year of 1905. The registered males are designated by numbers. It will be noted that the mother and the grandmother of the registered males are registered birds in the sense in which we use the word, the mother having yielded 203 and the grandmother 213 eggs in their first laying years. Beyond that, while the birds are pure bred, we do not know their breeding except that their mothers laid not less than 150 and not more than 199 eggs in their first laying years. The breeding of the unregistered males and females raised in 1905 differs from the registered in that none of the mothers have laid over 199 eggs in their first laying year.

Diagram illustrating breeding of registered males raised in 1905.



The figures in brackets below or at the right of the number of the hen indicate the egg yield for the first laying year

Diagram illustrating breeding of unregistered males and females raised in 1905.

Unregistered males and females raised in 1905.

- No. 302
  - No. 160
    - No. 66
      - No. 41
        - No. 44
          - ....
          - No. 286 (206)
        - No. 303 (208)
          - ....
          - ....
      - No. 676 (209)
        - No. 29
          - ....
          - No. 286 (206)
        - No. — (150-199
          - ....
          - ....
    - No. 1003 (240)
      - No. 52
        - No. 18
          - ....
          - No. 101 (204)
        - No. 326 (211)
          - ....
          - ....
      - No. — (150-199)
        - No. 21
          - ....
          - No. 286 (206)
        - No. — (150-199)
          - ....
          - ....
  - No. 224 (222)
    - No. 61
      - No. 40
        - No. 17
          - ....
          - No. 101 (204)
        - No. 318 (237)
          - ....
          - ....
      - No. 635 (201)
        - No. 24
          - ....
          - No. 101 (204)
        - No. — (150-199)
          - ....
          - ....
    - No. — (150-199)
      - No. 36, 37, 38 or 39
        - No. 17
          - ....
          - No. 101 (204)
        - No. 318 (237)
          - ....
          - ....
      - No. — (150-193)
        - No. 24
          - ....
          - No. 286 (206)
        - No. — (150-199)
          - ....
          - ....
- No. — (150-199)
  - No. 159
    - No. 51
      - No. 40
        - No. 17
          - ....
          - No. 101 (204)
        - No. 318 (237)
          - ....
          - ....
      - No. 635 (201)
        - No. 24
          - ....
          - No. 101 (204)
        - No. — (150-199)
          - ....
          - ....
    - No. 1003 (240)
      - No. 52, 53, 54 or 55
        - No. 18
          - ....
          - No. 201 (204)
        - No. 326 (211)
          - ....
          - ....
      - No. — (150-199)
        - No. 21
          - ....
          - No. 286 (206)
        - No. — (150-199)
          - ....
          - ....
  - No. — (150-199
    - No. 62
      - No. 41
        - No. 44
          - ....
          - No. 286 (206)
        - No. 303 (208)
          - ....
          - ....
      - No. 676 (209)
        - No. 29
          - ....
          - No. 286 (206)
        - No. — (150-199)
          - ....
          - ....
    - No. — (150-199)
      - No. 45, 46, 47 or 48
        - No. 24
          - ....
          - No. 101 (204)
        - No. 318 (237)
          - ....
          - ....
      - No. — (150-199)
        - No. 13
          - ....
          - No. 286 (206)
        - No. — (150-199)
          - ....
          - ....

The figures in brackets below or at the right of the number of the hen indicate the egg yield for the first laying year.

SIZES OF FLOCKS, ROOMS AND INDIVIDUAL FLOOR SPACES.

We are now using three large laying and breeding houses, and a smaller curtain front building known as the "Pioneer House."

House No. 1 is 16 feet wide and 150 feet long. This house is warmed by hot water and is always kept above the freezing point by the use of about four tons of coal each year. It has been in use seven years and the birds occupying it have laid well, and been in good health, but have not had as good color and were not as vigorous as their mates in the open front houses. The pens in this house are 10 by 16 feet in size and have been occupied by 20 hens, and during the breeding seasons generally by one or two males in addition.

House No. 2 is two years old. It is 12 feet wide and 150 feet long. Aside from the Pioneer House, this is the first curtain front elevated roosting closet house we built. It is fully described in Bulletin 100. The pens in this house are 12 by 20 feet in size and each one contains 50 hens, besides the cockerels at breeding time, which gives four and four-fifths square feet of floor space to each hen.

House No. 3 was constructed last fall. It is 16 feet wide and 120 feet long. It is of the same style as No. 2 except that it is wider. There are four pens in the building, each 16 feet wide and 30 feet long. Two of the pens are arranged for 100 hens each, and two of them for 150 each.

We have now used the Pioneer house four years with 50 pullets in it each year, the No. 2 house two years with 300 pullets each year and the No. 3 house one year. Besides these three houses, we have had the use of another house of the open front style of construction for three years with about 200 yearling, breeding hens in it each year.

These curtain front houses have all proved eminently satisfactory. Not a case of colds or snuffles has developed from sleeping in the warm elevated closets, with their cloth fronts, and then going directly down into the cold room, onto the dry straw, and spending the day in the open air. The egg yields per bird have been as good in these houses as in the warmed one. The purposes of the different sizes of rooms and flocks is to compare the results of the welfare and egg yields of the birds under the different conditions.

The conditions that were laid down years ago and accepted as imperative, that hens could only be kept profitably as layers in flocks not greater than 15, with allowances of at least 10 square feet of floor space per bird, required large space for small numbers of birds and was expensive. The small pen, even though sparsely populated, means close confinement to the occupants. If one hen was confined and compelled to remain on the generous allotment of a square yard, life would be very unsatisfactory to her. But give her 25 square yards of floor room to roam over at will and she will be happy, although she may meet 49 neighbors in her wanderings, and divide the room with them, yet the allotment to each individual is reduced to one-half a square yard.

The seven pens in House No. 2 each have 240 surface feet of floor and the 50 pullets in each pen averaged 150 eggs last year. The pullets this year, in the same pens, appear to be doing equally well.

In House No. 3 the pens are twice as large as those of No. 2, containing 480 square feet. In the first pen 100 pullets are kept, having four and eight-tenths square feet of floor per bird, just the same allotment as is given in the pens of 50 birds, in the No. 2 house. Some of the questions which it is hoped to get light upon by these comparisons are: Does the larger room have advantages over the smaller one when both are equally densely populated, by giving greater opportunities and freedom to the birds? Are there disadvantages when the numbers of birds in the flock are increased, the proportioned floor space per bird remaining the same.

Should the tests indicate that the greater liberties of the larger pens are advantageous, the question arises: are the advantages such that the number of birds in the large pens can be increased and the ratio of egg production be maintained, or; how far can the net profit from the pens be increased by increasing the number of birds in each pen, although the average egg yield be diminished by the denser population?

In House No. 3, pen No. 3 is a duplicate of pen No. 1 in size and construction, and in it 150 pullets were wintered. The floor allotment per bird in this flock is three and one-fifth square feet. Three roosts instead of two were required for the increased number of birds. The wider floor of the elevated closet makes the daily cleaning of the platforms, proportionately, a little greater, but not much so, as the roosts are elevated by a single rope pulley.

Although the cubic feet of air space per bird was the same in the flocks of 50, 100 and 150, the cloth covered fronts of the closets where 100 or 150 roosted were of the same size and it was very evident early in the winter that the supply of fresh air to the largest flock was not sufficient. It was not practicable to materially increase the cloth surface and allow more air to filter in, so three openings were made in the upper part of the curtain frame through which better ventilation could be secured. The openings were six inches wide and 30 inches long with wooden shutters provided for them. The shutters were kept entirely open into the outer room, during mild nights, but when high winds prevailed and the temperature fell to 10 or 30 degrees below zero, the openings were partially closed, but never more than half so.

The walls of the elevated closet are packed with sawdust four inches in thickness, and the curtains fit very closely, leaving very small cracks. The ten ounce duck of which the curtains are made is not oiled, as was the case with those in the original house built by us. The supply of fresh air was mostly admitted through the cloth, while the worn out air passed off through the openings above. By this arrangement the birds were not in drafts or currents or air. Where three roosts are arranged abreast, instead of two, the openings are absolutely essential and for smaller flocks they are convenient during the mild nights, especially towards spring.

The health of the birds in this flock of 150 in comparison with those in the flock of 100, in like sized pens, was apparently as good. In the pens of 50, 100, and 150 birds, the proportional losses did not materially differ, being very small in all pens.

It is yet too early to draw conclusions from the results as we have only the data of one year from November to June to compare. Next year we expect to have seven pens of 50 pullets each with floor space of 4.8 square feet per bird, and two pens of 100 birds each, with floor space of 4.8 feet per bird to compare with them. Also two pens of 150 birds each with floor space of 3.2 feet per bird to compare with the flocks of 100 birds above mentioned.

With pens of the same style and arrangement and birds of our own raising, matched in age, development and breed, and with the same system of feeding and attendance, information should be secured regarding the sizes of rooms and numbers in flocks which may be of incalculable value to the poultry industry of the country.

Feeding the Hens.

For 25 years we have been at work with the same family of Barred Plymouth Rocks and have learned several ways to feed and handle them to secure eggs, and to avoid the losses which are so common to mature hens of that breed, from over fatness. Other methods of feeding may be as good or even better. While it is true that only the full fed hen can lay to the limit of her capacity, it is equally true that full feeding of the Plymouth Rocks, unless correctly done, results disastrously.

Several years ago we gave up the morning mash and fed it late in the afternoon with far better results than when fed in the morning. The full meal in the morning had produced laziness, fatness and soft shelled eggs in our Plymouth Rocks, but these bad conditions and results were not encountered when the birds were required to eat slowly, and exercise by digging the hard grains out of the straw bedding.

The birds were fed throughout the year daily as follows: Each pen of 22 received one pint of wheat in the deep litter early in the morning. At 9.30 A. M. one-half pint of oats was fed to them in the same way. At 1 P. M. one-half pint of cracked corn was given in the litter as before. At 3 P. M. in winter and 4 P. M. in summer they were given all the mash they would eat up clean in half an hour. The mash was made of the following mixture of meals: 200 ℔s. wheat bran; 100 ℔s. corn meal; 100 ℔s. wheat middlings; 100 ℔s. linseed meal; 100 ℔s. gluten meal; 100 ℔s. beef scrap. The mash contained one-fourth of its bulk of clover leaves and heads obtained from the feeding floor in the cattle barn. The clover was covered with hot water and allowed to stand for three or four hours. The mash was made quite dry, and rubbed down with the shovel in mixing, so that the pieces of clover were separated and covered with the meal. Cracked bone, oyster shell, clean grit, and water were before them all of the time. Two large mangolds were fed to the birds in each pen daily in winter. They were stuck onto large nails which were partly driven into the wall a foot and a half above the floor. Very few soft shelled eggs were laid and so far as known, not an egg has been eaten by the hens during the last five years.

The records of several years' feeding show that from 50 to 55 pounds of the dry meals, not including the clover leaves of which the mash was made up, were eaten by each hen per year. The quantity of grain fed in the litter was the same every day, winter or summer. The quantity of mash was variable, being all they would eat in an hour at the close of the day. They ate more in cold than in warm weather; also considerably more when they were laying heavily than when they were yielding few eggs.

The feeding above described was with hens in a house kept warm enough by hot water pipes, so that the temperature was above the freezing point at all times. The amount of food required by the birds kept in this house for several years was always less during the winter season, than where birds were kept in the colder houses.

In addition to the 50 to 55 ℔s. of mash, the hens in this house have averaged each year 18.2 ℔s. wheat; 6.4 ℔s. cracked corn; 5.8 ℔s. of oats; 5.9 ℔s. oyster shell; 3.2 ℔s. dry poultry bone; 2.9 ℔s. mica grit; and 40 ℔s. mangolds. The straw for litter has averaged 36 ℔s. per bird.

The birds fed and housed as above described have averaged laying about 150 eggs each.

CRACKED CORN AND BEEF SCRAP SUBSTITUTE FOR THE MOIST MASH.

Last year 300 April and May hatched pullets were put in six pens in the open front house and the birds in all pens were selected so as to have the lots equal in quality. One hundred and fifty of the birds were fed on dry grains in the litter during the day and a full feed of moist mash was given towards evening. The mash was made as above described.

The other 150 birds were fed the same quantities and kinds of dry grains in the litter, but instead of moist mash they were given all they would eat of dry cracked corn in troughs at evening. Dry beef scraps were kept within their reach at all times. Both lots were constantly supplied with oyster shell, dry crushed bone, and mica crystal grit. Mangolds were fed through the winter and when the runs were bare in summer, other green food was supplied.

The materials used by each lot during the full year average per bird as follows:

Pounds of dry grain, straw, mangolds, etc., per bird for one year.

Lot 1 with mash—Mash, 53.3 pounds; wheat, 23.8 pounds; cracked corn in litter, 7.7 pounds; oats, 6.9 pounds; oyster shell, 8.5 pounds; bone, 4.4 pounds; grit, 4.2 pounds; beef scrap, —; mangolds, 40 pounds; straw, 36 pounds.

Lot 2 without mash—Cracked corn, 45.4 pounds; wheat, 23.8 pounds; cracked corn in litter, 7.7 pounds; oats, 6.9 pounds; oyster shell, 4.4 pounds; bone, 1.7 pounds; grit, 2.9 pounds; beef scrap, 14.7 pounds; mangolds, 40 pounds; straw, 36 pounds.

Cost of food and straw, Lot 1, $1.73; Lot 2, $1.69.

Cost of food without mangolds, Lot 1, $1.48; Lot 2, $1.43.

Eggs yielded, Lot 1, 151; Lot 2, 149.

Comparisons of the costs of the two rations and the egg yields of the birds fed upon them do not show very great advantages of one ration over the other. There were no marked differences in the appearances and health of the birds in the two lots. They were in good general health, aside from the difficulties that arise when birds are induced to overload their crops after a period of partial fasting. The free use of cracked corn cheapened the cost of the ration, and the egg yield was not depressed sufficiently to indicate that that ration was faulty in its production. When compared with the food required to feed a hen a year in the warmed house, which was about 95 pounds, the 109 pounds used in this test is an increase of nearly 15 per cent.

As the birds in each house laid about the same number of eggs, it seems reasonable to suppose that the excess of food was needed for maintenance in the colder house, where the birds were in out-of-door temperature during the most of the day time throughout the year.

Although as many eggs were yielded by the birds eating less food in the warmed house, the greater vigor and less losses among birds in the open-front house more than compensated for the excess cost of maintenance.

In Lot 2, where the birds helped themselves at will to beef scrap, they ate of it on the average, 14.7 ℔s. during the year; while in Lot 1 each bird received 8.7 ℔s. of the scrap in the mash. This leaves a difference of 6 ℔s. in the amount of animal food consumed by individuals in the two lots. Was this difference supplied by the materials rich in vegetable protein which made up a part of the mash, viz., the linseed and gluten meals?

It will also be noticed that the quantity of oyster shell, bone and grit eaten by the birds having a constant supply of beef scrap was markedly less than when the supply of scrap was limited to that contained in the mash.

DRY FEEDING.

On the first of last November we began feeding 550 April and May hatched pullets wholly on dry food. They were in the curtain-front houses with warm elevated roosting closets and in flocks of 50, 100 and 150. At five o'clock in the morning the flocks of 50 birds were given two quarts of cracked corn; at half past ten o'clock they had one quart of wheat and one quart of oats. This dry material was all spread on the litter on the floor but was not raked in. Along one side of the pens were feed troughs with slatted fronts, in which was kept a supply of the dry material of which the moist mash, before described, was composed. These troughs were never allowed to remain empty when the supply was exhausted. The dry mash was constantly within the reach of all birds and they helped themselves at will. Oyster shell, dry cracked bone, grit and charcoal were accessible at all times. A moderate supply of raw mangolds and plenty of clean warm water was furnished them. When they were first put upon this ration they were not acquainted with the dry mixture in the troughs and ate of it sparingly, but in three or four days they were using as much of it as at any later time until they got to laying heavily. When the feeds of cracked corn, wheat and oats were given, the birds were always ready and anxious for them and would scratch in the litter for the very last kernel before going to the troughs where an abundance of food was in store.

It was very evident that they liked the broken and whole grains better than the mixture of the fine materials; yet they by no means disliked it, for they helped themselves to it,—a mouthful or two at a time—whenever they seemed to need it, and never went to bed with empty crops so far as we could discover. They apparently did not like it well enough to gorge themselves with it, and sit down, loaf, get over fat and lay soft shelled eggs, as is so commonly the case with Plymouth Rocks when they are given warm morning mashes in troughs.

Some of the advantages of this method of feeding are that the mash is put in the troughs at any convenient time, only guarding against an exhaustion of the supply, and the entire avoidance of the mobbing that always occurs at trough feeding when that is made a meal of the day, whether it be at morning or evening. There are no tailings to be gathered up or wasted as is common when a full meal of mash is given at night. The labor is very much less, enabling a person to care for more birds than when the regular evening meal is given.

We cannot give the results of a full year's feeding in this way, as we have practiced it only from the first of last November to the close of June. The number of hens lost during the winter has been less than ever before, even when they were kept in the same style of houses. We can ascribe this to no other cause than that the birds did not overload with food at any time. We have never had so many eggs laid during the winter months by a like number of hens, but that may be due to better breeding, or to the open-front houses which the birds occupied.

During the 31 days of March the 550 birds consumed on the average, per bird, the following materials, viz.: Cracked corn, 2 ℔s.; wheat, 1.09 ℔s.; oats, .81 ℔s.; mash, 5.68 ℔s.; shell, .52 ℔s.; bone, .25 ℔s.; grit, .31 ℔s.; mangolds, 3.30 ℔s.

During the months when they were not laying so heavily the consumption of mash was but about four pounds and the demands for shell, bone and grit were less. It will be noticed that the proportion of wheat fed was less than in any former ration we have fed and that the cracked corn was increased, thus cheapening the ration.

The average yields of the 550 hens during March was 20.4 eggs per bird. The whole number of eggs laid by them during the six months from November 1st to April 30 was 42,126, an average of 76 per bird. It must be borne in mind that these birds were not selected but were the whole number of chickens reared last year.

FEEDING THE CHICKENS.

We used to bake bread* for the young chicks but have abandoned the practice, not because there is anything better for them, but we believe the work involved in preparing it is not necessary.

Infertile eggs are boiled for half an hour and then ground in an ordinary meat chopper, shells included, and mixed with about six times their bulk of rolled oats, by rubbing both together, enough to break the egg into small pieces. This mixture is the feed for two or three days until the little things have learned how to eat. It is fed sparingly, in the litter and sand on the brooder floor.

About the third day we commence to feed a mixture of hard, fine broken grains, i. e., cracked corn, wheat, millet and pinhead oats as soon as the birds can see to eat in the mornings. This is fed in the litter, being careful to limit the quantity so they shall be hungry at ten o'clock. We have used several of the prepared dry chick foods and like them when they are made of good clean grains and do not contain grit. The grit and charcoal can be supplied at less cost and must be freely provided.

At ten o'clock the rolled oats and egg mixture is fed, in tin plates, with low rims. After they have had the food before them five minutes the dishes are removed and they have nothing to lunch on except a little of the fine broken grain which they scratch for. At 1 o'clock the hard grains are again fed as in the morning and at 4.30 to 5 o'clock they are fed on the rolled oats and egg mixture, giving all they will eat until dark.

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* Bulletin 100 this station, page 8.

When they are about three weeks old the rolled oats and egg mixture is gradually displaced by a mixture made up of two parts by weight of good clean bran, 2 parts corn meal, 1 part middlings or Red Dog flour, 1 part linseed meal and 1 part fine beef scrap. This mixture is moistened just enough with water so that it is not sticky but will crumble when a handful is squeezed and then released. The birds are developed far enough by this time so that the tin plates are discarded for light flat troughs with low sides.

The hard broken grains may be safely used all the way along and the fine meals left out, but the chicks do not grow so fast as when the mash is fed. There seems to be least danger from bowel looseness when the dry grains only are fed and it is very essential that the mash be dry enough to crumble in order to avoid that difficulty. Young chicks like the moist mash better than though it was not moistened and will eat more of it. There is no danger from the free use of the properly made mash, twice a day, and being already ground the young birds can eat and digest more of it than when the food is all coarse. This is a very important fact and should be taken advantage of at the time when the young things are most susceptible to rapid growth. But the development must be moderate during the first few weeks. The digestive organs must be kept in normal condition by the partial use of hard foods and the gizzard must not be deprived of its legitimate work and allowed to become weak by disuse.

By the middle of June the chickens that were hatched in April are being fed on cracked corn, wheat and the mash. At about that time the portable houses with their contents of chickens are drawn from their winter locations out to an open hayfield where the crop has been harvested and the grass is short and green.

Until last season we had continued feeding two feeds of cracked corn and wheat and two of mash daily as long as the birds remained in the field. Last June we had 1,400 chickens well started and we changed the plan of feeding by keeping cracked corn, wheat, and beef scrap, in separate slatted troughs where they could help themselves whenever they desired to do so. Not more than one-fourth of the grain was wheat for the pullets, while in the cockerel division nothing but cracked corn and beef scrap were fed. Grit, bone and oyster shell were always supplied. There were no regular hours for feeding, but care was taken that the troughs were never empty.

The results were satisfactory. The labor of feeding was far less than that required by any other method we have followed. The birds did not hang around the troughs and over-eat, but helped themselves—a little at a time—and ranged off, hunting or playing and coming back again when so inclined to the food supply at the troughs. There was no rushing or crowding about the attendant as is usual at feeding time where large numbers are kept together. While the birds liked the beef scrap they did not over-eat of it.

During the range season—from June to the close of October—the birds ate just about one pound of the scrap to ten pounds of the cracked corn and wheat. They had opportunity to balance their rations to suit themselves by having the two classes of food to select from always at hand. It would seem that we had not been far wrong in our previous feeding, as the birds used just about the same relative amounts of scrap to other food, when they had liberty to do so, that we had formerly mixed in for them.

We are not able to say whether this method is more or less expensive of material, than when we fed the four feeds each day at regular hours. As near as we could calculate, there were no appreciable differences.

The birds did well under this treatment. The cockerels were well developed and we never raised a better lot of pullets. The first egg was laid when the oldest pullets were four months and ten days old. For the last six years the pullets have been from four months and ten days to four months and twenty days old when the first eggs were found. This year we shall make another change by adding dry mash to the menu,—having a trough of that material beside the ones containing beef scrap and cracked corn. The difficulty of keeping the food clean and dry during continued exposure is nearly overcome by using troughs with slatted sides and broad, detachable roofs. We make them from six to ten feet long, with the sides five inches high. The lath slats are two inches apart and the troughs are sixteen inches high from floor to roof. The roofs project about two inches at the sides and effectually keep out the rain except when high winds prevail.

The roof is very easily removed by lifting one end and sliding it endwise on the opposite gable end on which it rests. The trough can then be filled and the roof drawn back into place without lifting it. This arrangement is the best of anything we have found for saving food from waste and keeping it in good condition. When dry mash is used in it there is considerable waste by the finer parts being blown away. When used for that purpose it is necessary to put it in a sheltered place out of the high winds.